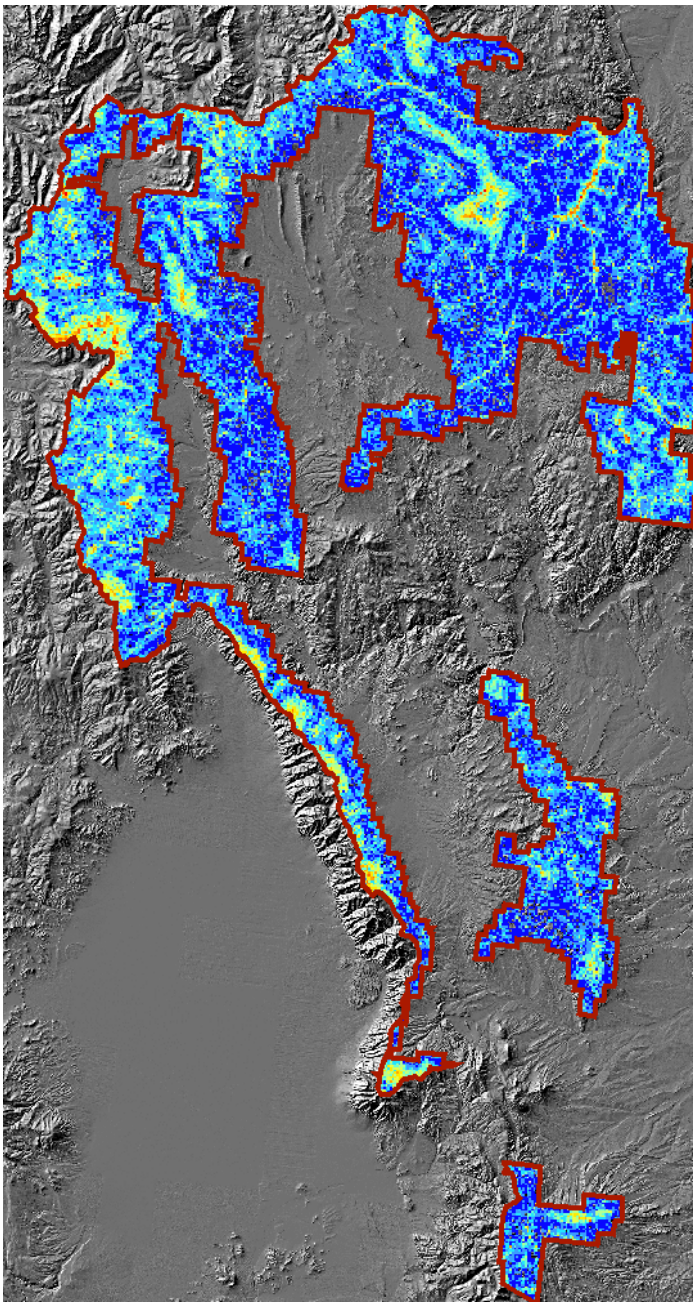
# *Soci*al *V*alues for *E*cosystem *S*ervices (SolVES), Version 2.0: Quick-Start Tutorial



Ben Sherrouse
U.S. Geological Survey
Rocky Mountain Geographic Science Center
bcsherrouse@usgs.gov

# INTRODUCTION

In response to the need for incorporating quantified and spatially explicit measures of social values into ecosystem services assessments, the Rocky Mountain Geographic Science Center (RMGSC), in collaboration with Colorado State University, developed a geographic information system (GIS) application, *So*cia*l V*alues for *E*cosystem *S*ervices (SolVES). With version 2.0 (SolVES 2.0), RMGSC has improved and extended the functionality of SolVES, which was designed to assess, map, and quantify the perceived social values of ecosystem services. Social values such as aesthetics, biodiversity, and recreation can be evaluated for various stakeholder groups as distinguished by their attitudes and preferences regarding public uses, such as motorized recreation and logging. As with the previous version, SolVES 2.0 derives a quantitative, 10-point, social-values metric, the Value Index, from a combination of spatial and nonspatial responses to public attitude and preference surveys and calculates metrics characterizing the underlying environment, such as average distance to water and dominant landcover. Additionally, SolVES 2.0 integrates Maxent maximum entropy modeling software to generate more complete social value maps and to produce robust statistical models describing the relationship between the social values maps and explanatory environmental variables. The performance of these models can be evaluated for a primary study area, as well as for similar areas where primary survey data are not available but where social value mapping could potentially be completed using value-transfer methodology. SolVES 2.0 also introduces the flexibility for users to define their own social values and public uses, model any number and type of environmental variable, and modify the spatial resolution of analysis. With these enhancements, SolVES 2.0 provides an improved public domain tool for decisionmakers and researchers to evaluate the social values of ecosystem services and to facilitate discussions among diverse stakeholders regarding the tradeoffs among different ecosystem services in a variety of physical and social contexts ranging from forest and rangeland to coastal and marine.

SolVES 2.0 was developed using VB.NET and is packaged as a custom toolbar for ESRI®[1] ArcGIS 9.3 GIS software. It requires the Spatial Analyst Extension for working with grid-based data. SolVES 2.0 was developed and tested on systems running Microsoft® Windows 7 Enterprise Edition but should function with any operating system supported by ArcGIS 9.3. SolVES 2.0 also requires the installation of Maxent maximum entropy modeling software, version 3.3.3e. Lastly, the computer must also run the .NET Framework and Java. Processing time will vary depending on factors such as the computer's processor speed, the spatial resolution and extent of the study area, and the number of variables selected for analysis.

This tutorial provides step-by-step instructions to install SolVES 2.0 and to complete practice exercises using the available sample data. It is meant to quickly provide some hands-on experience using SolVES 2.0. For more detailed information regarding SolVES 2.0, including its design, functionality, data requirements, and troubleshooting, please refer to the SolVES, Version 2.0 User Manual available for download at *solves.cr.usgs.gov*.

[1] Any use of trade, product, or firm names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

## DISCLAIMER

Please be advised that SolVES 2.0 is applied at your own risk. The U.S. Department of the Interior, or the system authors cannot assume responsibility for system operation, output, interpretation, or use.

SolVES 2.0 is a tool for mapping and analyzing social survey response data. It is not a tool designed for the collection of survey data, nor is any survey attached to SolVES 2.0. Any survey or survey response data referred to in the SolVES 2.0 documentation, sample data, or publications is the work and responsibility of the persons or groups who developed and conducted that survey. Please note that before a Federal agency may collect information or sponsor a collection of information, the Paperwork Reduction Act (PRA) requires approval from the Office of Management and Budget (OMB). Any Federal agency or sponsored program interested in developing and conducting a survey for use with SolVES 2.0 is wholly responsible for submitting an Information Collection Request (ICR) to OMB.

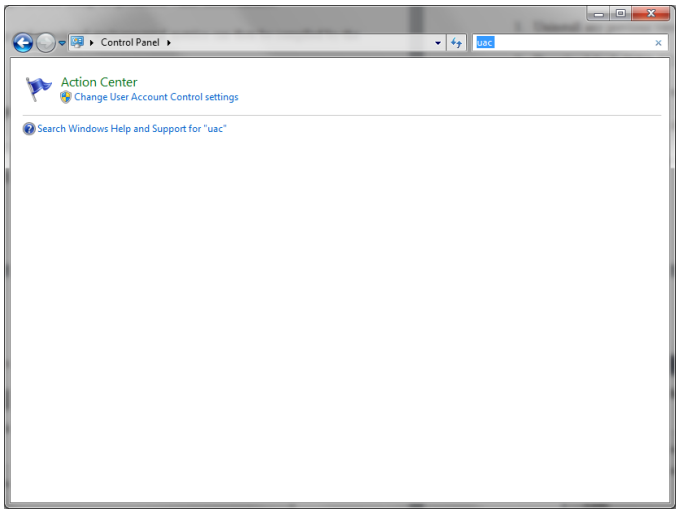
# INSTALLATION

Installation requires the user to have administrative privileges on their computer.

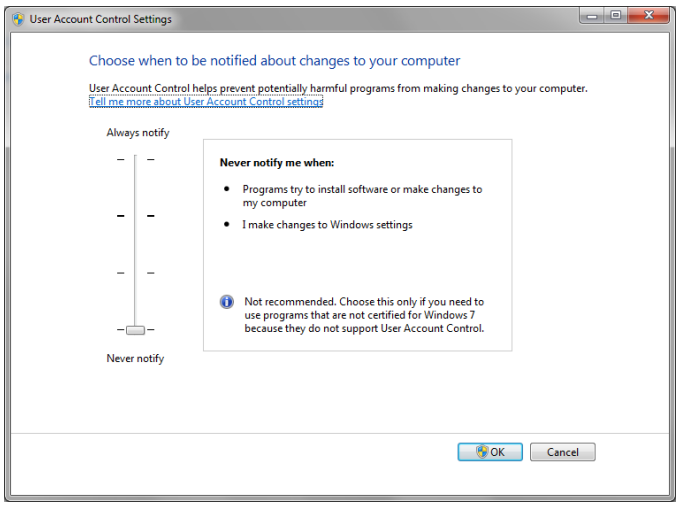
## Special SolVES 2.0 Installation Instructions for Microsoft Windows Vista and Windows 7

If the installation is made on a computer running Windows Vista or Windows 7, the following steps may be necessary prior to completing the General Installation Instructions.

1. Open the Control Panel.
2. Search for “uac”.




3. Select Change User Account Control settings from the search results.
4. Note the original position of the slide bar for restoring the setting later, and then move the slide bar down to “Never notify”.

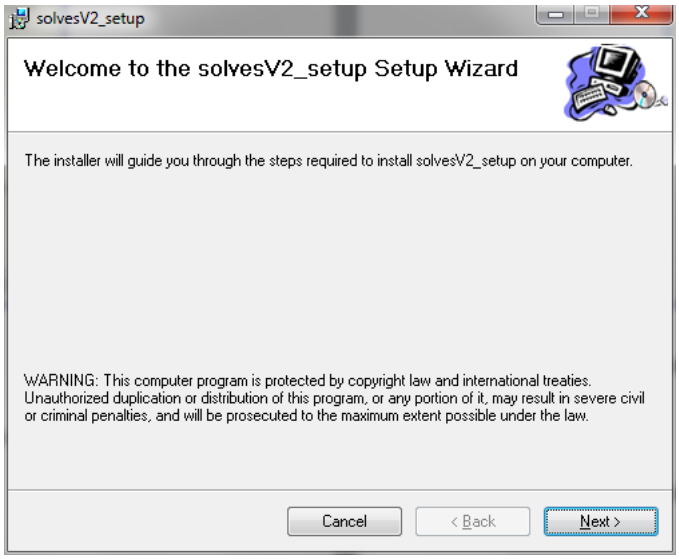


5. Select OK.
6. Restart the computer.
7. Be sure to restore the original User Account Control settings after completing the SolVES 2.0 installation. (This may also require a computer restart.)

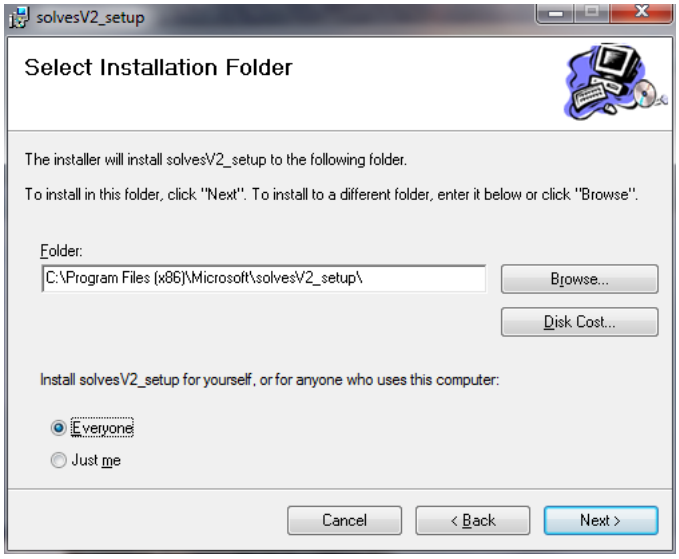
## General SolVES 2.0 Installation Instructions

Complete the following steps to finish the SolVES 2.0 installation process.

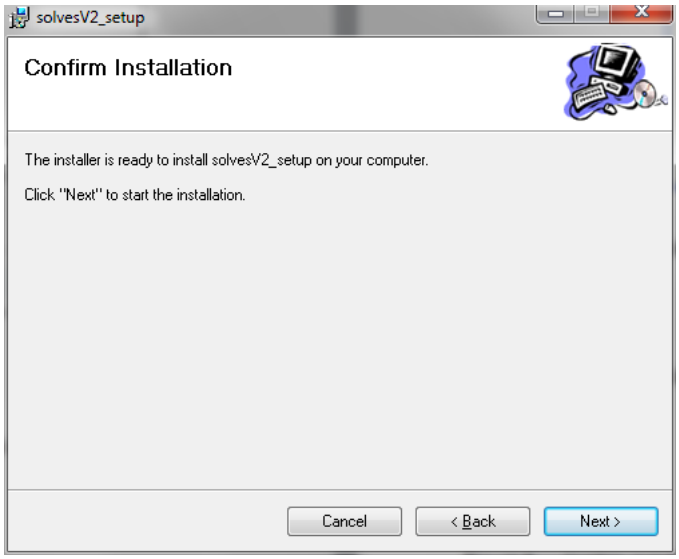
1. Uninstall any previous version of SolVES.
2. Download the SolVES_V2.zip file from the SolVES website *http://solves.cr.usgs.gov* and place it in a temp directory on the computer.
3. Unzip the file to the temp directory.
4. Run the solvesV2_setup.msi installation file by double clicking on the file.
5. Click Next on the Welcome to the solvesV2_setup Setup Wizard screen.



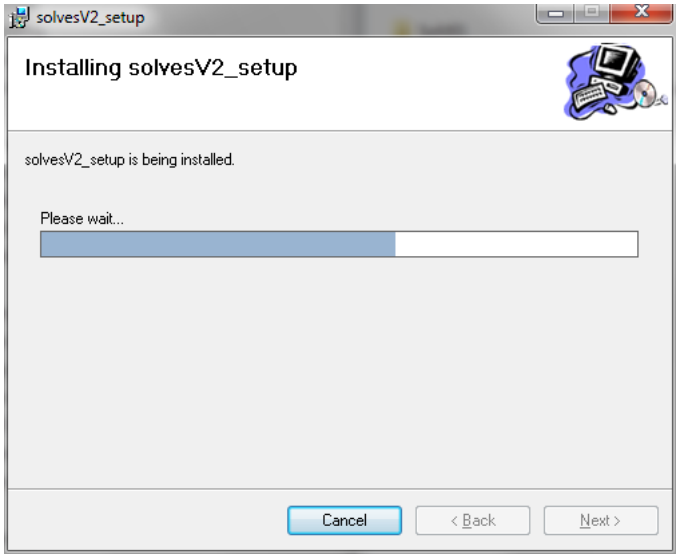
6. On the Select Installation Folder screen, use the default folder or select another.



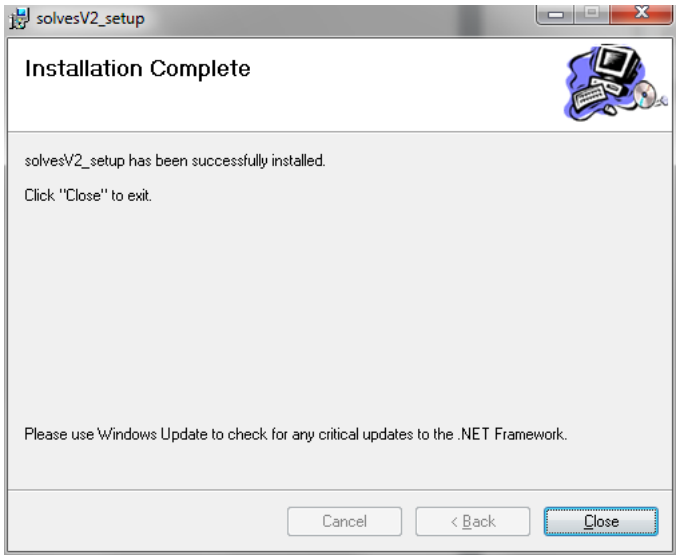

7. Select the radio button next to “Everyone”.
8. Click Next on the Select Installation Folder screen.
9. Click Next on the Confirm Installation screen.



10. Wait while the tool is being installed.

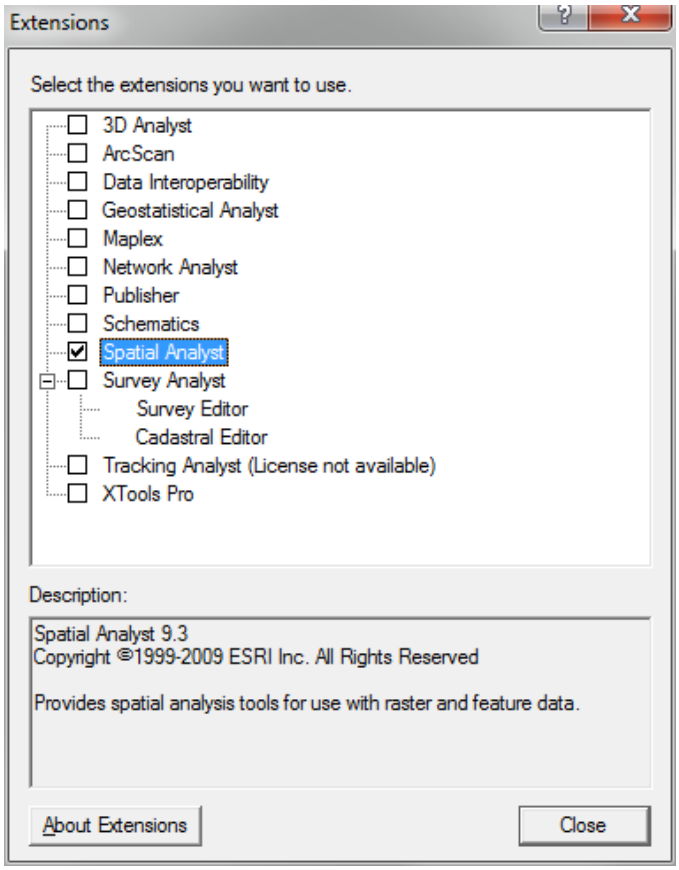



11. Click Close on the Installation Complete screen after the tool has been installed.

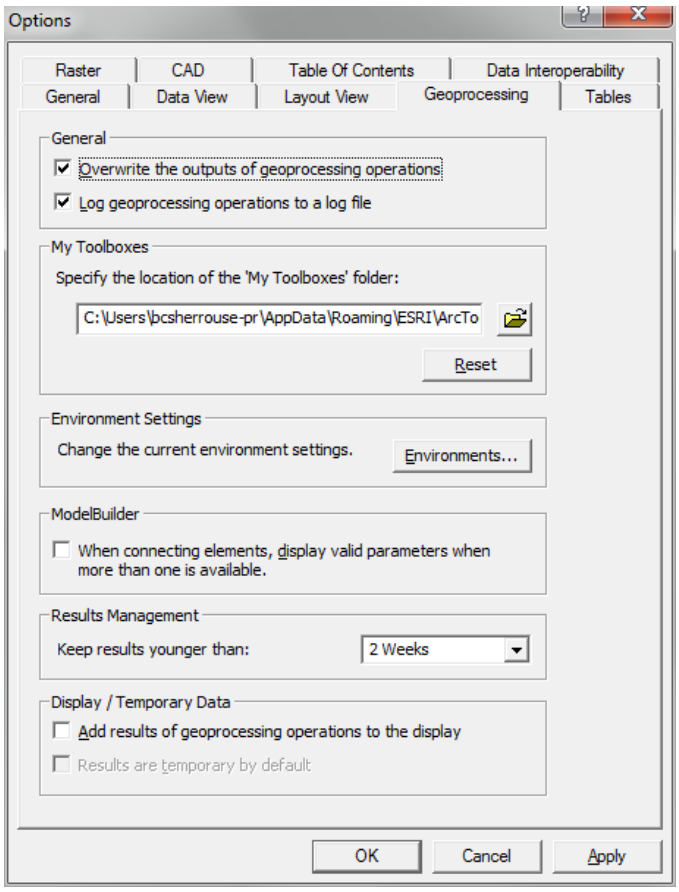


## Adding the SolVES 2.0 Toolbar to ArcMap

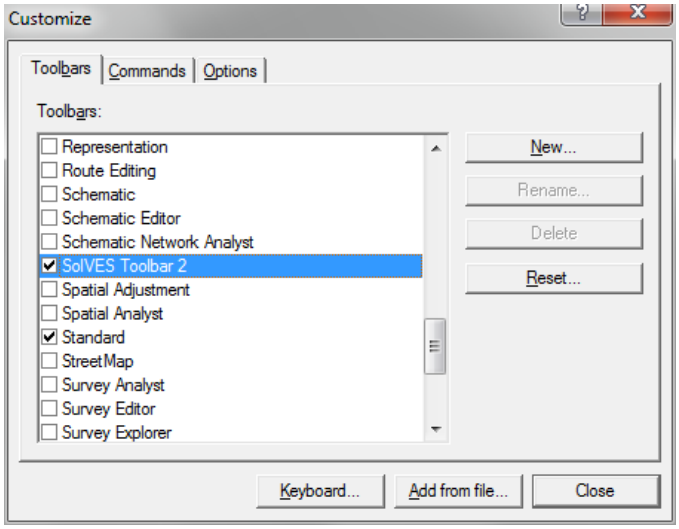
1. Open ArcMap.
2. Choose Tools -> Extensions from menu.
3. Click on “Spatial Analyst”.




4. Close the Extensions form.
5. Choose Tools -> Options from menu.
6. Select the Geoprocessing tab.
7. Under General, be sure the checkbox next to “Overwrite the outputs of geoprocessing operations” has been checked.

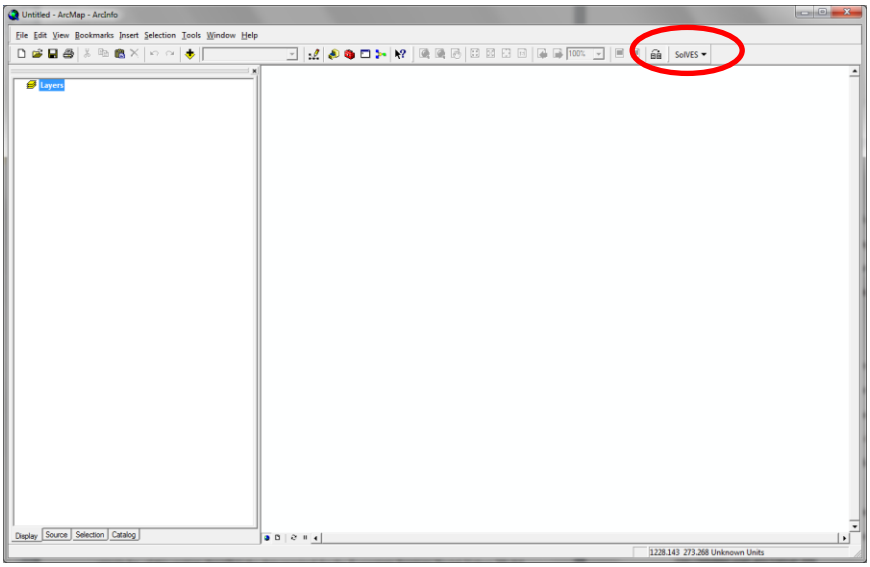



8. Choose Tools -> Customize from menu.
9. Click on SolVES Toolbar. The toolbar listing may be followed by a numeral 1 or 2 but this should not impact the installation.




10. Close the Customize form.

11. The SolVES toolbar will be added to ArcMap.
12. Place the tool in the menu area of ArcMap.




## Maxent Maximum Entropy Modeling Software Installation Instructions

Maxent maximum entropy modeling software is freely available for educational and research activities; however, it is not authorized for redistribution by its users. Maxent must be downloaded directly from the Maxent website *www.cs.princeton.edu/~schapire/maxent/*. The website also contains various links to additional information regarding Maxent. After navigating to the website, complete the following steps:

1. Follow the website instructions to download Maxent version 3.3.3e. This is not the current version of Maxent, but an archived version.
2. Return to the location of the unzipped SolVES 2.0 download file and copy the three downloaded Maxent files (maxent.bat, maxent.jar, and readme.txt) into the Maxent folder contained within the SolVES root directory.

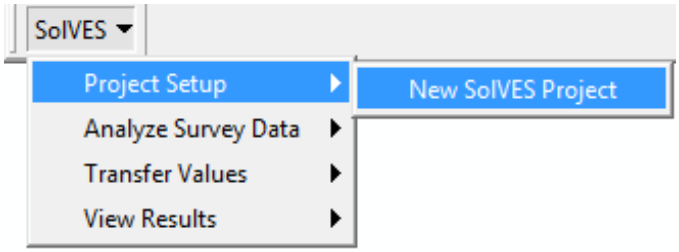
## Data Installation

1. Copy the SolVES root directory to a local directory that will serve as the SolVES 2.0 home directory.
2. Download the sample file geodatabases containing data for the Pike and San Isabel National Forests and Grand County, Colorado, from the SolVES website *http://solves.cr.usgs.gov*.
3. Unzip the downloaded sample data file.
4. After downloading and unzipping the sample file geodatabases, select one of the SolVES.gdb files (based on the exercise to be completed) and copy it into the Data folder contained within the SolVES root directory.

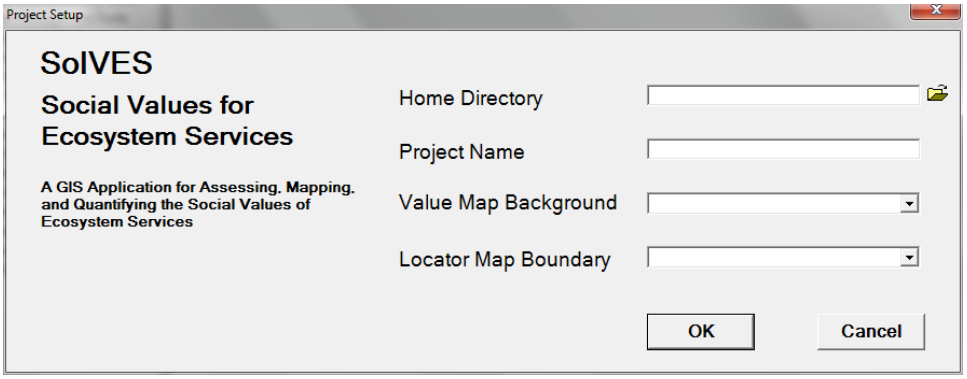
## EXERCISE #1: USING THE ANALYZE SURVEY DATA AND VIEW RESULTS TOOLS

For this exercise, copy the SolVES.gdb file containing the Pike and San Isabel National Forests sample data to the Data folder in the SolVES root directory. The Analyze Survey Data tool will use social survey data collected for the Pike and San Isabel National Forests to analyze aesthetic and recreation values for survey respondents opposed to motorized recreation in the Forests. The View Results tool will then be used to generate a map layout for aesthetic value.

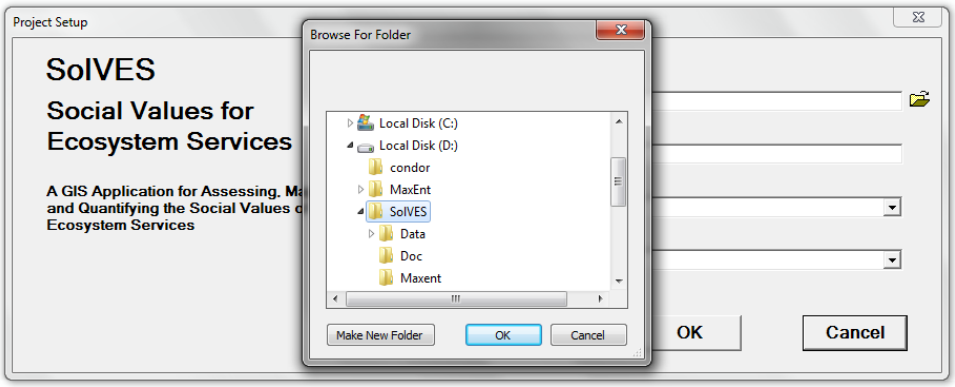
1. Select Project Setup and New SolVES Project from the SolVES toolbar.



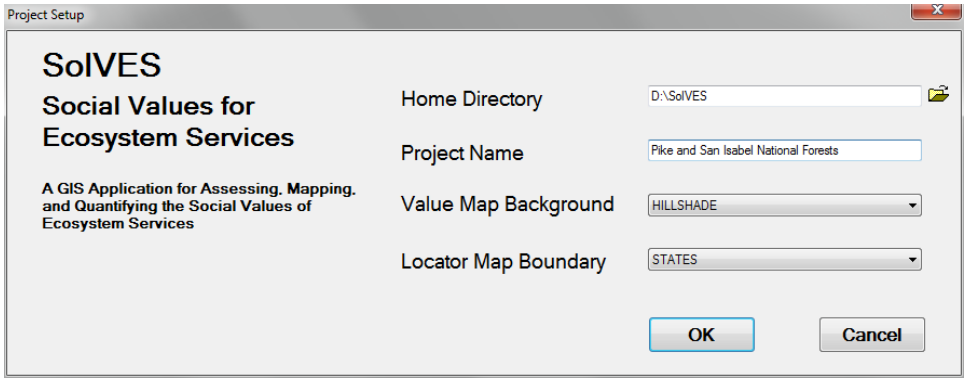

The following screen will appear.



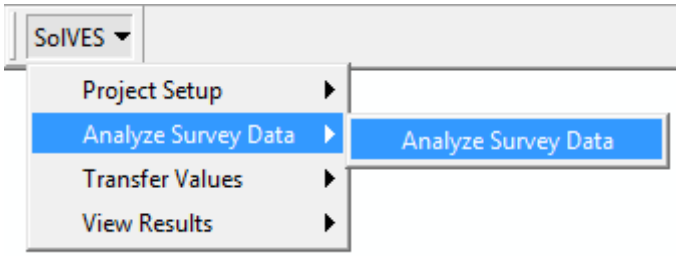
2. Navigate to wherever the SolVES root directory is located to set the Home Directory.




3. Enter the Project Name "Pike and San Isabel National Forests".
4. Leave "HILLSHADE" as the default Value Map Background.
5. Leave "STATES" as the default Locator Map Boundary.

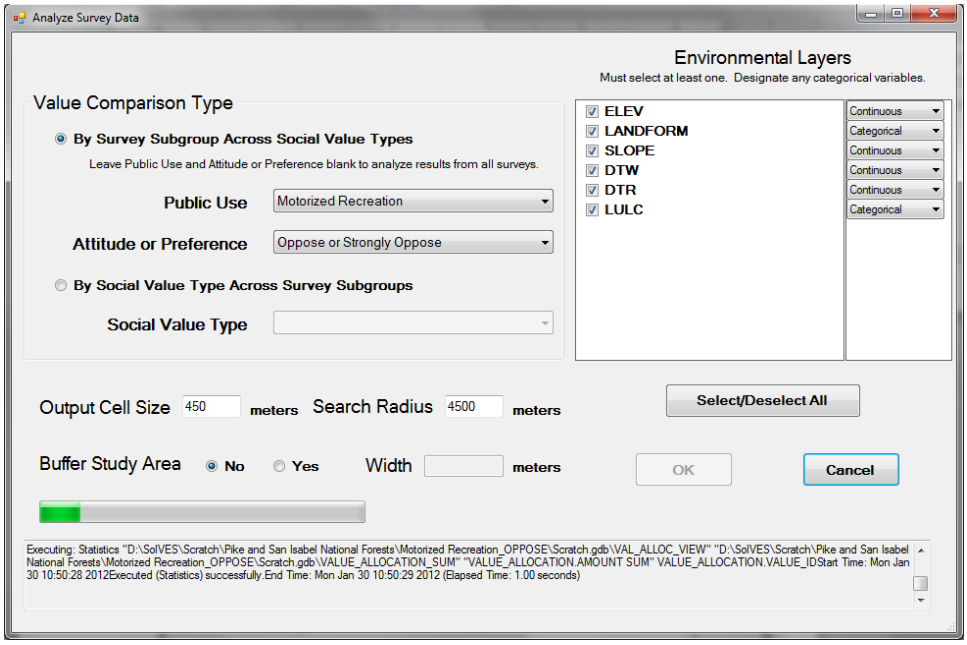



6. Select OK.
7. Select the Analyze Survey Data tool from the toolbar.

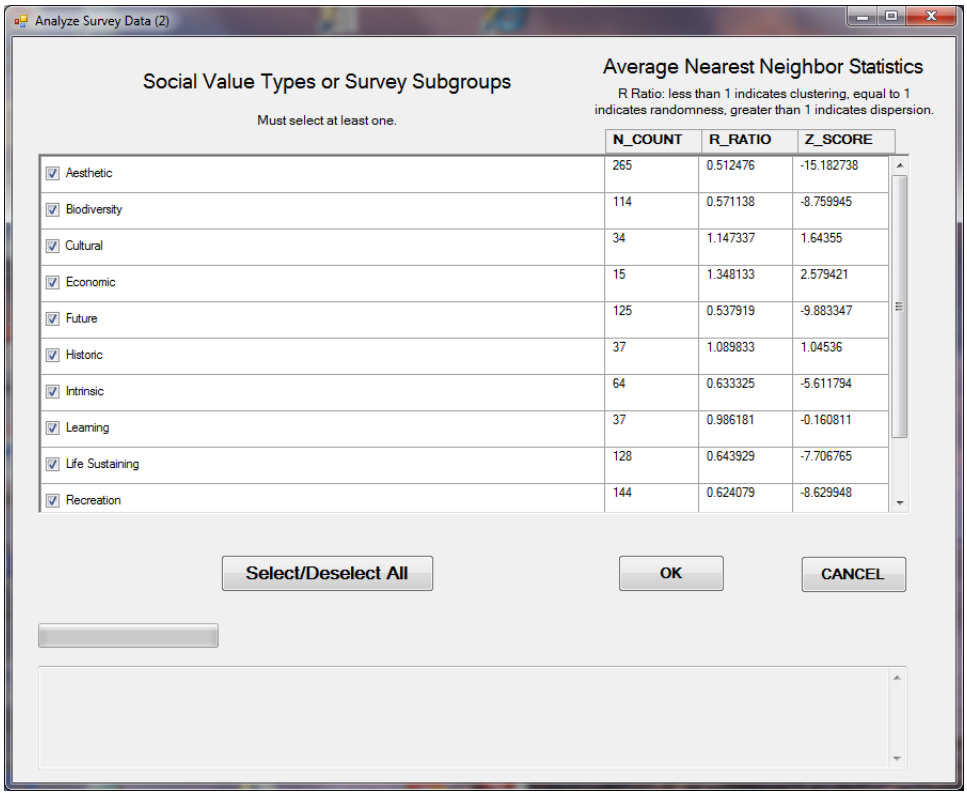



8. Select the radio button next to By Survey Subgroup Across Social Value Types.
9. Select "Motorized Recreation" from the Public Use dropdown list.

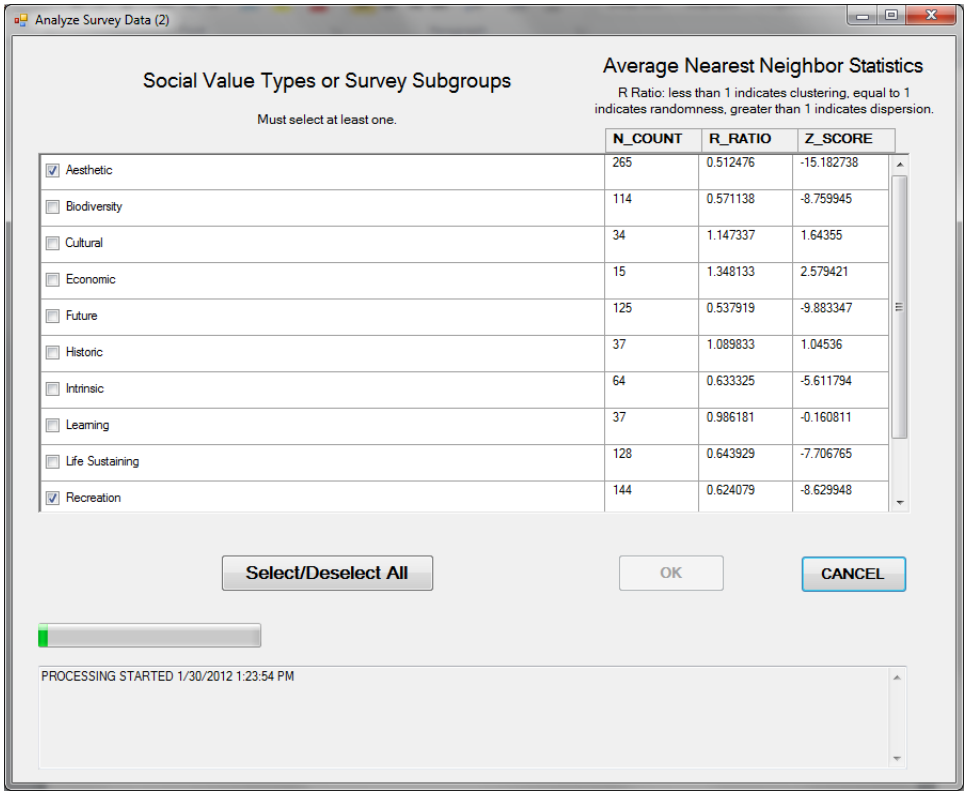
10. Select “Oppose or Strongly Oppose” from the Attitude or Preference dropdown list.
11. Enter 450 into the Output Cell Size field. (This value is determined from the survey map scale).
12. Leave the default Search Radius value as 4500.
13. Leave the default Buffer Study Area as No.
14. Leave all of the Environmental Layers selected.
15. Select “Categorical” from the dropdown list next to LANDFORM.
16. Select “Categorical” from the dropdown list next to LULC.
17. Select OK.



After a few minutes, the following screen will appear.

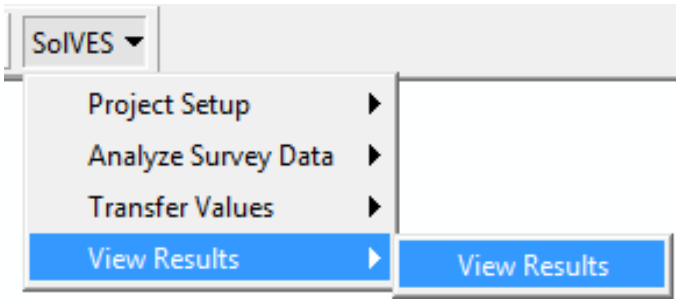



18. Deselect all items in the list by selecting Select/Deselect All.
19. Select the checkboxes next to Aesthetic and Recreation.
20. Select OK.

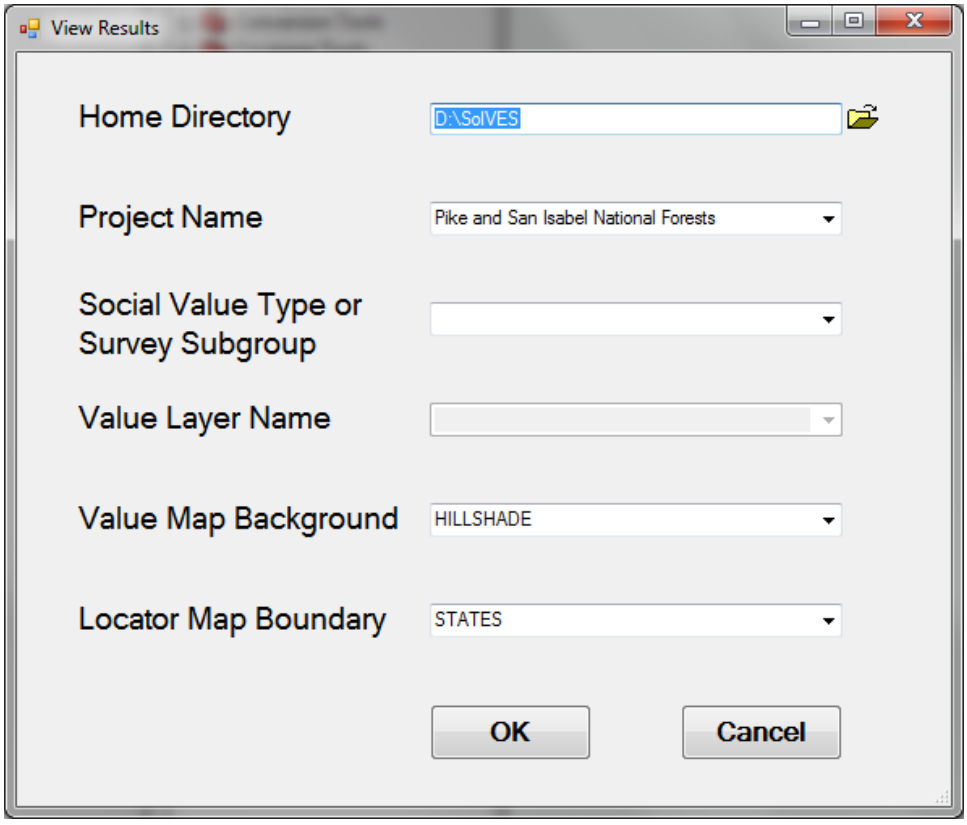



For a few minutes during processing, the Maxent user interface will be partially visible behind the above screen. Do not attempt to interact with the Maxent user interface because it may cause SolVES 2.0 to malfunction. After several minutes, the tool will finish processing and an empty ArcMap document will be visible. Now it is time to review some of the results produced by the Analyze Survey Data tool.

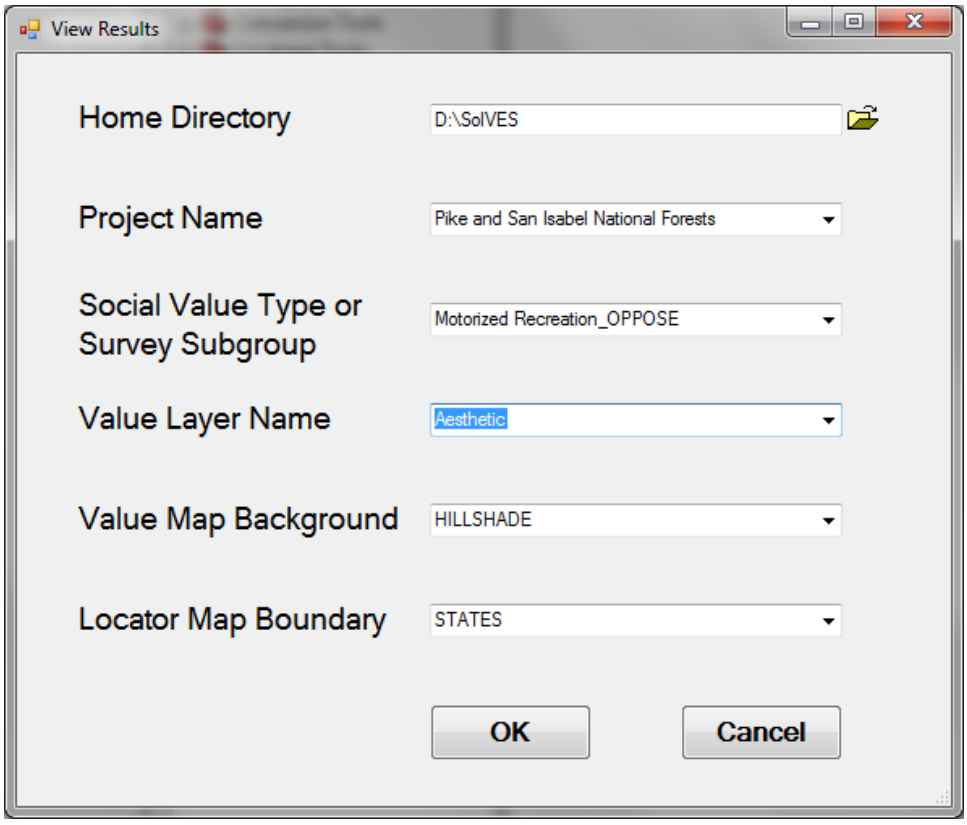
1. Select the View Results tool from the toolbar.



The following screen will appear.

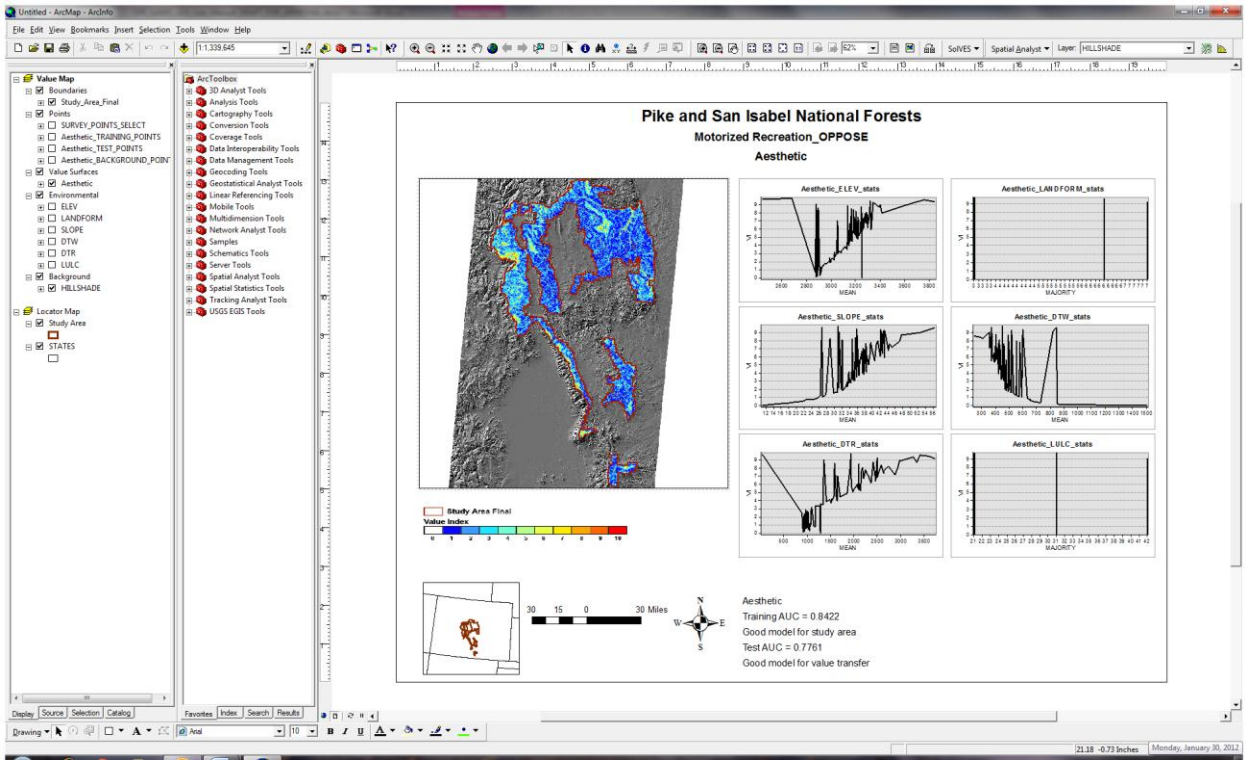



2. Leave the existing Home Directory, Project Name, Value Map Background, and Locator Map Boundary values as they are.
3. Select "Motorized Recreation_OPPOSE" from the Social Value Type or Survey Subgroup dropdown list.
4. Select "Aesthetic" from the Value Layer Name dropdown list.


View Results
Home Directory
D:\SolVES
Project Name
Pike and San Isabel National Forests
Social Value Type or Survey Subgroup
Motorized Recreation_OPPOSE
Value Layer Name
Aesthetic
Value Map Background
HILLSHADE
Locator Map Boundary
STATES
OK
Cancel

5. Select OK.

A map layout is generated showing aesthetic value across the Pike and San Isabel National Forests for survey respondents opposed to motorized recreation in the Forests. The layout also includes graphs reporting environmental metrics across the Value Index gradient. Statements regarding the performance of the model generated for the Pike and San Isabel National Forests as well as the model's potential performance in transferring values to similar study areas are included below the environmental metric graphs.

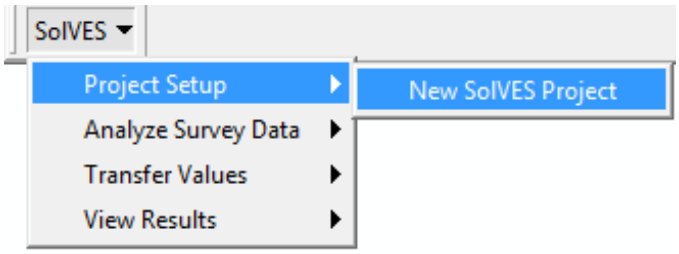



This is the end of Exercise #1.

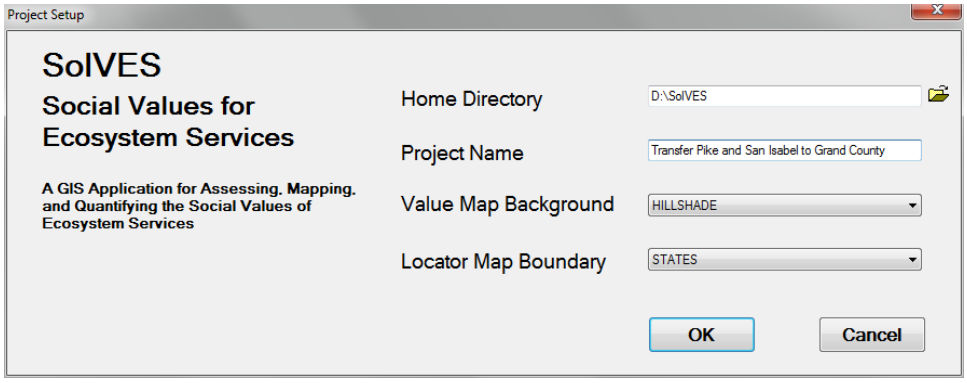
## EXERCISE #2: USING THE TRANSFER VALUES AND VIEW RESULTS TOOLS

For this exercise, copy the SolVES.gdb file containing the Grand County, Colorado, sample data to the Data folder in the SolVES root directory. The Transfer Values tool will be used to apply the aesthetic value model generated from the Pike and San Isabel National Forests social survey data to an area immediately north of the Forests, Grand County, Colorado.

1. Select Project Setup and New SolVES Project from the SolVES toolbar.

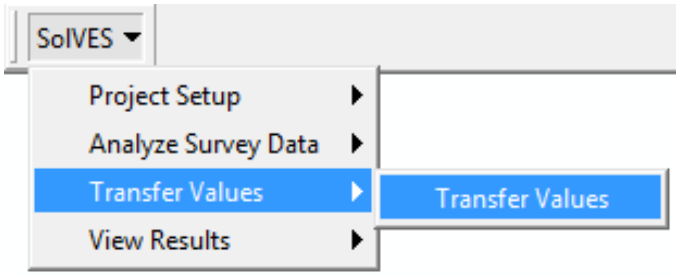



2. Once the Project Setup form is open, navigate to wherever the SolVES root directory is located to set the Home Directory.
3. Enter the Project Name "Transfer Pike and San Isabel to Grand County".
4. Leave "HILLSHADE" as the default Value Map Background.
5. Leave "STATES" as the default Locator Map Boundary.

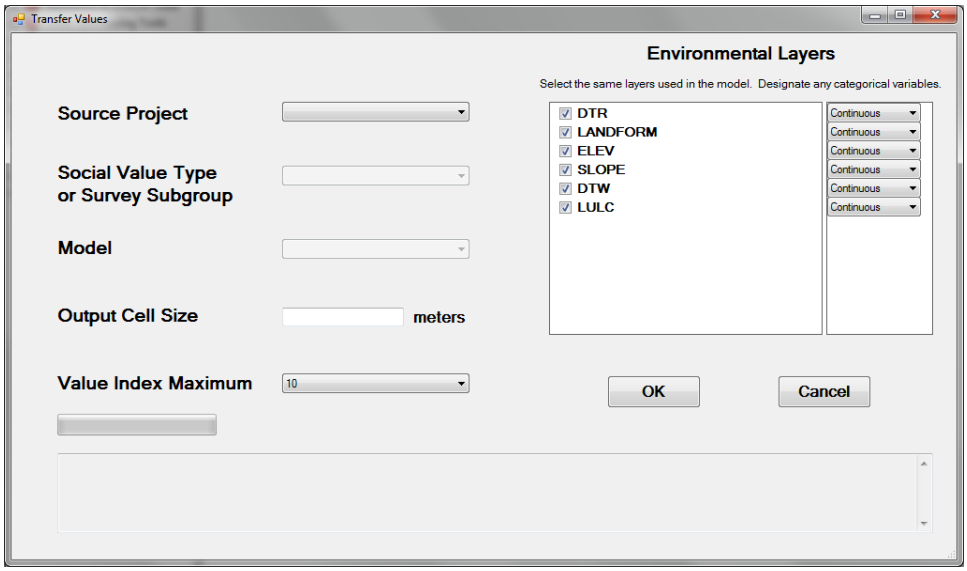



6. Select OK.

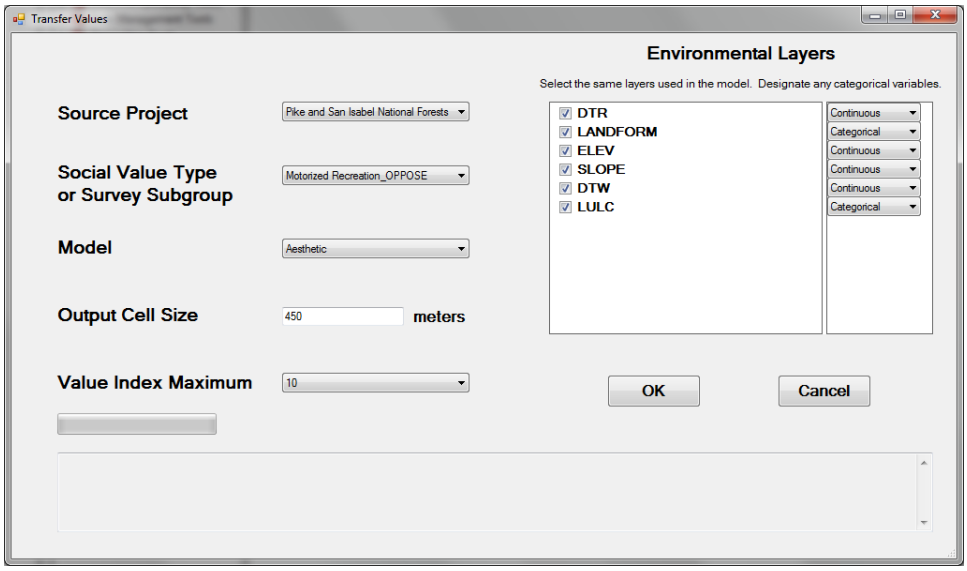
7. Select the Transfer Values tool from the toolbar.




The following screen will appear.

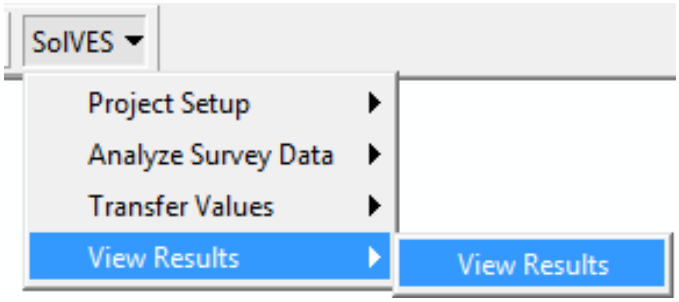



8. Select "Pike and San Isabel National Forests" from the Source Project dropdown list.
9. Select "Motorized Recreation_OPPOSE" from the Social Value Type or Survey Subgroup dropdown list.
10. Select "Aesthetic" from the Model dropdown list.
11. Enter 450 into the Output Cell Size field. (The model will be applied at the same resolution it was originally generated).
12. Leave the default Value Index Maximum as 10.
13. Leave all the Environmental Layers selected.
14. Select "Categorical" from the dropdown list next to LANDFORM.
15. Select "Categorical" from the dropdown list next to LULC.
16. Select OK.

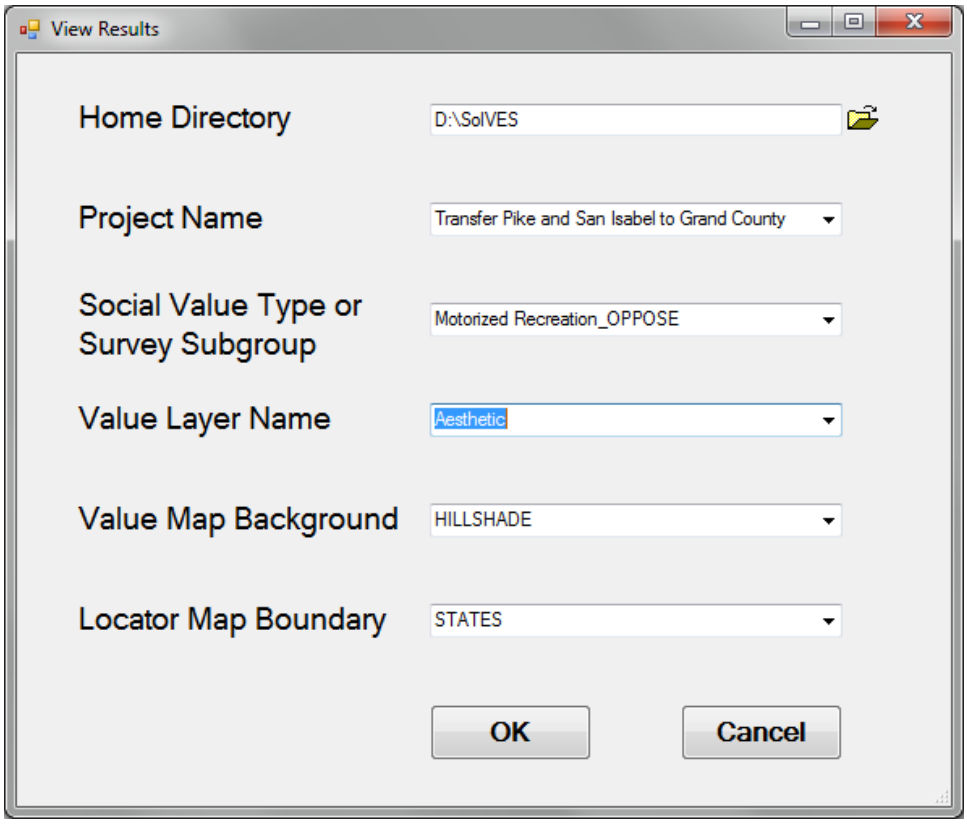



After a few minutes, the tool will finish processing and an empty ArcMap document will be visible. Now is the time to review the results produced by the Transfer Values tool.

1. Select the View Results tool from the toolbar.

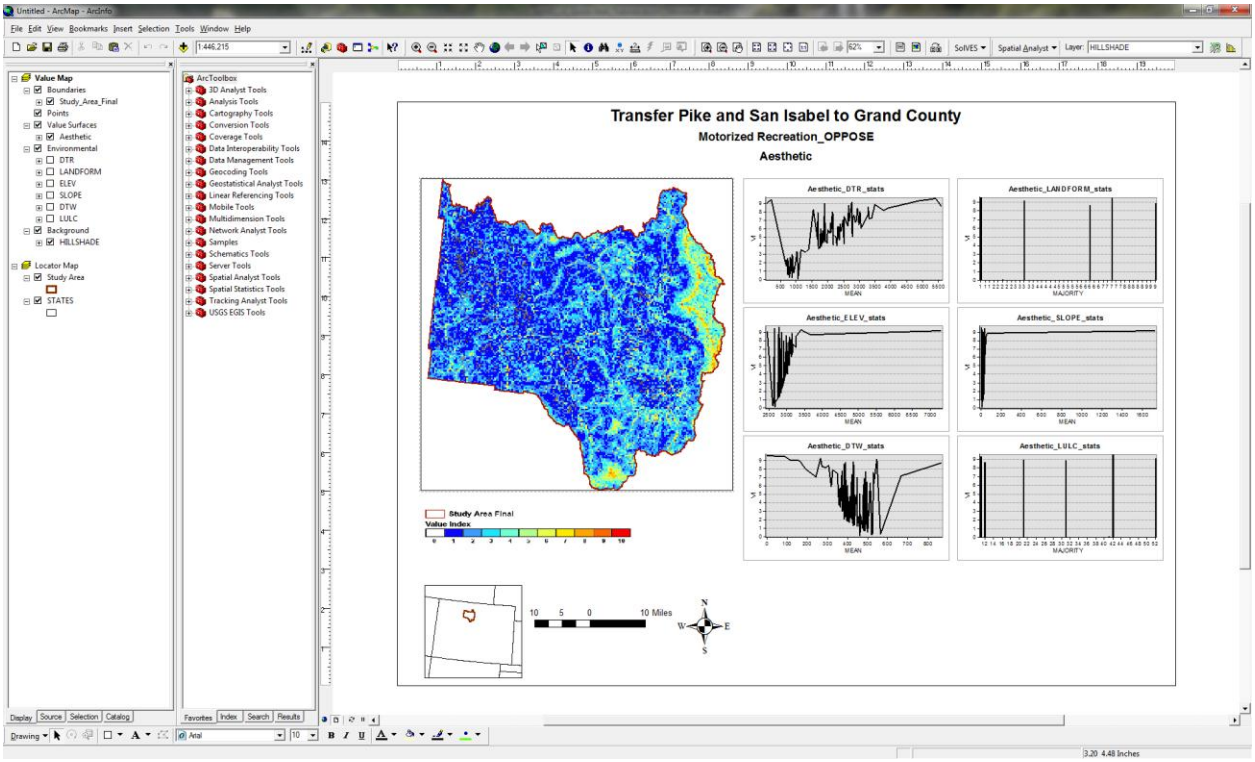



2. Leave the existing Home Directory, Project Name, Value Map Background, and Locator Map Boundary values as they are.
3. Select "Motorized Recreation_OPPOSE" from the Social Value Type or Survey Subgroup dropdown list.
4. Select "Aesthetic" from the Value Layer Name dropdown list.


View Results
Home Directory
D:\SolVES
Project Name
Transfer Pike and San Isabel to Grand County
Social Value Type or Survey Subgroup
Motorized Recreation_OPPOSE
Value Layer Name
Aesthetic
Value Map Background
HILLSHADE
Locator Map Boundary
STATES
OK
Cancel

5. Select OK.

A map layout is generated showing predicted aesthetic value across Grand County, Colorado, for survey respondents opposed to motorized recreation. Since no survey data were available for Grand County, the map was produced by using the model generated from the survey data for the Pike and San Isabel National Forests. The layout also includes graphs reporting the environmental metrics across the Value Index gradient.




This is the end of Exercise #2.

Again, for more detailed information regarding SolVES 2.0, including its design, functionality, data requirements, and troubleshooting, please refer to the SolVES, Version 2.0 User Manual available for download at *solves.cr.usgs.gov*.